THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

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A Representative American Electrical Manufactory.

In our leading article of Sept. 8 ult., in which we studied the relations of "The Incandescent Light and Decorative Art," as exemplified at the Munich Electrical Exposition, we promised to show to our readers that American products in this line are quite equal to those of European art. To enable us to fulfill our promise, we paid a visit some time ago to the establishment of Messrs. Bergmann & Co., Avenue B and Seventeenth street, this city, who manufacture the fixtures and appliances used in installations of the Edison system of electric lighting. Our chief object, as just intimated, was to examine the elegant electrical chandeliers and brackets of artistic design and finish, for which the establishment is already well known, in order that we might paint pen pictures of the beauties and merits of American decorative and ornamentative art for our readers. But as it happened, our admiration was not evoked only by the beautiful chandeliers and fixtures which we saw; for as we passed from floor to floor, in our survey of this immense factory, Mr. Bergmann, who was kind enough to escort us, pointed out to us many interesting things, which have led us to enlarge the scope of our article. In addition to making the Edison fixtures, Messrs. Bergmann also make several other accessory appliances necessary with the Edison system, among which are the lamp sockets, current switches, current regulators, both hand and automatic, current meters and safety catches—in fact, we may say that everything but the Edison dynamos and lamps are made here. The manufacture of electrical instruments of precision, such as galvanometers, rheostats, etc., is also a specialty; and besides this, work is done for various outide concerns on contract. While going on our round we saw work in progress for the Gold & Stock Telegraph Co., the Law Telegraph Co. and the Holmes Burglar Alarm Co.

The factory itself, with its improved machinery and large complement of help, the variety of work done in he different departments, the system and order with which the materials went through the various processes of transformation in their evolution toward a perfect finished article, were among the features which excited our interest. We were better prepared to appreciate the excellency of the productions turned out of this factory after we had had this opportunity to judge for ourselves of the facilities it affords for doing good work.

The factory of Messrs. Bergmann & Co. is a handsome brick building situated on the northwest corner of the junction between Seventeenth street and Avenue B. It occupies an area of 125 by 100 feet and is six stories high. The building is divided into two parts by a thick brick wall with open arched doorways connecting them. This mode of construction insures stable and solid floors, which is very essential where heavy machinery is to be used. The building is provided with elevators having self-opening and closing hatchways. On the roof is a tank which holds 3,000 gallons of water, to supply sprinkle pipes placed in the different parts of the building. The work to be done is mostly of a light character and does not require much power, probably not over 75 horse-power for the whole establishment. This power is furnished by a 150 horse-power Corliss engine, located on the ground floor next to the offices. The boiler adjoins the engine room. On the ground floor is a brass foundry, where the brass and composition castings used for the chandeliers, switches, regulator frames, lamp sockets, etc., are made; and we must remark, *en passant*, that the castings for ornamental fixtures, with *intaglio* and *rilievo* chased designs, were the smoothest and most perfect we have ever seen. There is also a cabinet shop adjoining the foundry, where the woodwork needed in the construction of the various appliances is made. The remaining space on the ground floor is given up to the shipping and storage departments, with the exception of a small testing-room. This room is provided with delicate measuring instruments, including a Thomson reflecting galvanometer. This apparatus is used to measure the constants of the wire purchased for use, and thus to determine its quality. It is also used to calibrate resistances and measuring apparatus made in the factory, and it serves for experiments. Mr. Edison, whose laboratory now occupies the sixth floor of this building, not unfrequently avails himself of the use of this small testing-room. There is another small laboratory in the factory, with dark chamber photometer, etc. On the second floor we find the heavier machinery, such as engine lathes, machine lathes, die presses, drilling machines and screw machines. They form a diversified and highly interesting collection. We watched a workman making the neat little binding screws that add so much "electrical" grace to a piece of electrical apparatus: and they were turned, threaded and finished almost as fast as we could count them. The workmen on this floor are among the most skilled of those employed in the whole factory, for it is here that the finest machine work is done. The lathes and heavy machinery are grouped on one side of the building as much as possible, and the other portion of this floor is devoted to the construction of fine apparatus. The Gold & Stock "tickers are made in this portion, and the unequaled workmanship which we found bestowed on the wheels and pinions alone evinced, in our opinion, the high class of skill of the workmen who make them. The automatic regulators used with the Edison dynamo-electric machines (described and illustrated in our issue of Sept. 1), are also made here. Besides these, galvanometers of all kinds, ampère-meters, voltmeters are also made. Several galvanometers, both simple and astatic, and some reflecting galvanometers, of the Thomson single and double needle pattern and rheostats in the laboratory of Mr. Edison, are made by Messrs. Bergmann & Co., and they exhibited a workmanship quite equal to that of the best Elliott Brothers (London) make. On the third floor there is quite a distinction between the operations conducted on either side of the middle brick partition. One side is in a measure a continuance of that last described. Some Gold & Stock apparatus is made here, either wholly or partly, and in addition the work of this department includes burglar-alarm apparatus (Holmes' Burglar-Alarm Co.'s) annunciators, signal-bells, telephone apparatus and similar contract work. On

DISPLAY OF EDISON ELECTRIC LIGHT FIXTURES IN SHOW ROOM OF BERGMANN & CO.

the other side of the building is the department where the fusible "safety catches" and the lamp sockets are made. This presents a very busy and interesting appearance.

The sockets, Fig. 1, are those devices on the branches of the fixtures which are intended to support the Edison lamps, and which are provided with keys similar to those of gas fixtures, whereby the current is put on or cut off, the lamps fitting into each. Since we described them in our issue of Sept. 1, an important improvement has been realized in their construction. Originally, by turning the key its stem moved inward, so that its inner end came into contact with two brass strings and closed the circuit between them. There were two objections to this mode of completing the lamp-circuit: First, there was no friction at the contact by which the oxidation, caused by the spark on opening the circuit, could be removed; and, second, when the key was turned backward to break the circuit its motion was not as abrupt as would be desirable to prevent all possibility of the formation of a minute arc at the break, whereby the oxidation of the contact would be greatly increased. In outward appearance the socket still remains the same, but the circuit is now closed in a different manner.

One wire of the loop is connected with the threaded portion into which is screwed the lamp, and is therefore in connection with one end of the carbon filament, which end, as we know, is connected to the metallic thread around the neck of the lamp. The other end of the carbon filament is connected to a small metallic disc on the end of this threaded neck. In the latest socket the contact is closed by the bent end of the flat spring, which comes up against this disc with a grazing motion, thus affording what is usually known as a rubbing contact. The spring itself is placed longitudinally in the cylindrical portion of the socket, and it normally tends to press the key-stem outward by pressing on its inner end. The stem is prevented from passing out, however, by a screw. As the key is turned, this screw rubs against the cam-shaped projection on the inside end of the tubular cavity into which the stem turns, and the stem is forced inward, thus pressing the spring whose upper bent extremity in turn presses against the contact disc on the socket-end of the lamp, as just described. Not only is there a strong rubbing contact produced, but also a contact of considerable pressure, since the spring has to yield at that point before the key has been fully turned. When the key is turned backward this spring falls back again, at first without breaking contact, until the key has sufficiently turned back to clear the stop in the cam, and then the spring falls back abruptly, opening the circuit with a quick motion.

This improvement not only insures better working, but it simplifies the construction of the sockets. In the old socket was a structure of boxwood turned and bored in various ways. In the new socket a small brass casting and a disc of gelatinized fibre answer this purpose. The brass springs and the pieces by which they are fastened to the structure are made of sheet brass by machinery. To see these little pieces of brass cut out in peculiar shape and bent and bored in many ways, it seems as though it would take an hour to make one, but instead of that they are "evolved" all in an instant. They fall from the machine stamp or punch all cut, bent and bored; and a small boy can make them just as well as a skilled machinist. The cams by means of which the inward motion of the key stem is produced are also made by machinery. In fact, there is scarcely anything more than the putting of the parts together that is done by hand. The sockets are made of various styles to answer all purposes, both with and without key. Usually the socket is to be screwed to the end of an arm of a fixture. But it may be fastened to a stand or to a clamp. Fig. 2 shows a "spike socket" which may be driven into a wall.

An important improvement has also been realized in the manufacture of the smaller safety catches. These are no longer made of wood, but are molded out of a cement composition of which calcined magnesia forms the chief constituent. The advantages claimed for this composition are that it does not shrink or absorb moisture like wood, and cannot be burned or charred in case the fusible wire is melted by the current.

There is a testing department on this floor, where the conductivity of various parts, joints and contacts of each apparatus is tested. The tests also indicate whether the connections are made properly or not. At this place the safety catches are all tested. It is well known that the different sizes of these safety catches are intended to convey a current for a different number of lamps. It is important that it should not fuse when carrying a smaller current. Each catch, as soon as made, is tested. For this purpose there is a bank of 200 Edison lights, for which the current is furnished by an Edison dynamo on the ground floor. By means of a switchboard any number of these lamps may be connected. To test a safety catch it is only necessary to include it in the main circuit and connect the number of lamps for which it is intended. If the fusible wire is too small, it will fuse at once, and another one of larger size is used to replace it.

On this floor there is a stock room for the supply of tools and materials, which is in charge of a clerk. In this inclosure the coils and helices used in the construction of electrical apparatus are wound.

The fourth floor is devoted to the manufacture of chandeliers. Here the brass castings are worked, put together, finished and polished, japanned, lacquered, bronzed or plated. The japanned parts are baked in a special oven heated by exhaust steam. The lacquering is also done by utilizing the heat of exhaust steam. The plating is done in a separate room, and the current is supplied for this purpose by a small dynamo electric machine of very low resistance and low electro-motive force. The current from this machine can also be used to excite a large electro-magnet which is used for magnetizing purposes. There are a few lathes on this floor for the convenience of the metal workers in assembling the parts of chandeliers. The grinding and polishing is all done in a separate room which occupies a part of the other half of the floor. In this part are numerous emery wheels and buffing wheels for the purpose. The remaining portion of this half of the floor is given up to the carbon and battery department. In this place are prepared carbon strips of various sizes for a variety of uses, though mostly for battery purposes. The carbon is not molded, but is sawed out from the densest retort carbon by means of special machinery similar to that used for sawing marble. It is claimed that these carbons are more homogeneous, purer and denser than those which are prepared by agglomeration.

Messrs. Bergmann & Co. manufacture all kinds of voltaic batteries but they make a specialty of a new type (Fig. 10) lately introduced by them as a substitute for the Leclanché battery. This battery certainly possesses many advantages over the Leclaché battery in shape, cleanliness and in cost, while it seems to promise superiority in point of efficiency. As it is our intention to return to this battery at a later occasion, with some competitive and comparative tests, we shall not discuss it further this time. On the fifth floor—which is the last so far as our description is concerned, the sixth floor being devoted to the laboratory of Mr. Edison, as already stated—one half of the space is occupied by the manufacture of Edison meters for circuits of from 6 lights to 100 lights. The resistances used in regulating the Edison dynamos are also made here. These consist of German-silver wires coiled around square upright structures and freely exposed to the cooling influence of the air on all sides.

The switches by means of which the connections are made between the main conductors and the branches of a circuit are also constructed here, and the process of their manufacture is as simple as that of the sockets. They have been slightly improved since our description in the article of Sept. 1. In the first form the switch is held in the "closed" position by a catch which holds its stem. In the latter form the stem is moved down by a short lever with cammed end, which remains in place when pressed down, but which springs up readily when released by a touch of the hand.

These switches are made for circuits or branches supplying from 3 to 250 lights.

Mr. Bergmann informed us that there is one sub-foreman on each floor, or "department." Each department also has its "experiment corner," where all the experiments for that department are conducted by the sub-foreman or by assistants. The total number of employés in the whole establishment is about 325.

Now that we have given our readers an idea of the character and importance of this factory we shall revert to our first task, and point out the excellence of its products from the ornamental point of view. This bids us pass on

Fig. 1.—Standard Socket.

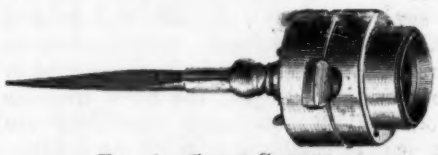

Fig. 2.—Spike Socket.

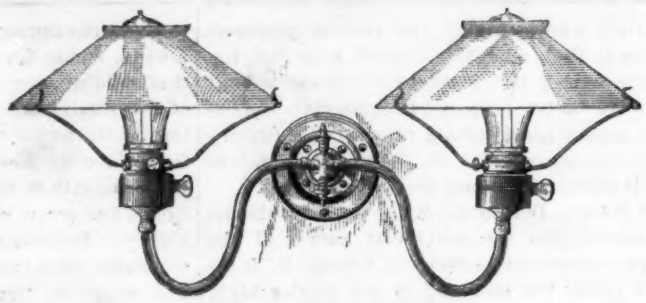

Fig. 3.—Plain Bracket.

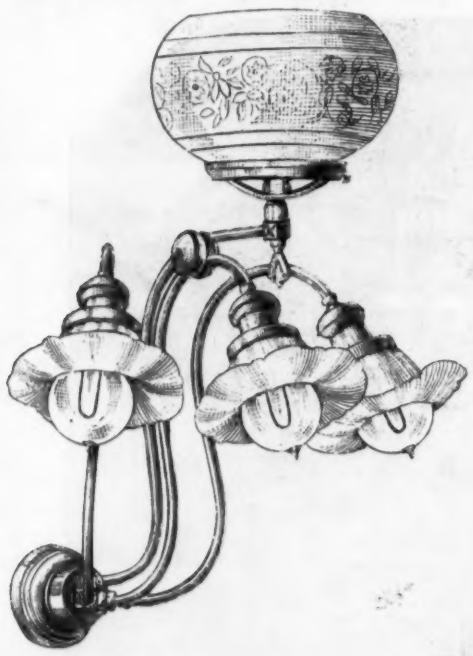

Fig. 4.—Combination Electric Light and Gas Bracket.

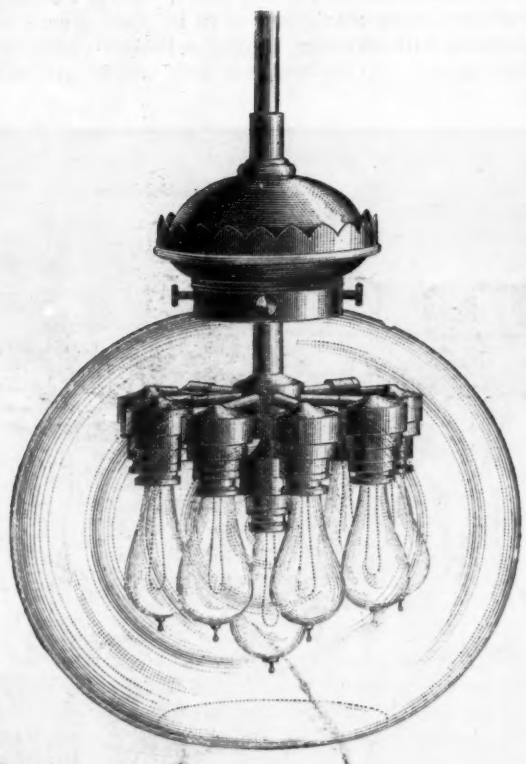

Fig. 5.—Cluster Globe for Display.

Fig. 6.—Ornamental Sconce.

to a feature of great interest even to the most "unelectrical" of observers—the show-room. Our front page illustration represents a portion of this show-room, which occupies one-half of the fifth floor, the other half being occupied by the meter department as already stated. We must concede, however, that in spite of the talent

FIG. 7.—BOUQUET STANDARD.

of the artist and the skill of the engraver, it fails to reproduce faithfully the magnificent display which presented itself to our view as we entered the show-room.

Polished metals, brilliant lacquers outlining the framework of each fixture, glass globes, pendants, and ornaments of every conceivable shape and every possible color, and, withal brilliant flowers, all combined to surpass the rich munificence of the grandest pageantry and to remind us of a peep at fairy land. But we had not yet seen this spectacle in all its richness and its grandeur. The curtains are lowered, so as to darken the room, and then a switch is pressed, when behold! there is light—from a myriad of small globes. Another switch is pressed, and another row of fixtures instantly becomes resplendent. The current is supplied from the dynamo on the ground floor, and there is an automatic regulator in the show-room which regulates the supply of current, according to the demand. While we are here let us say a word of the arrangement of the conductors which support the fixtures and at the same time convey the current to them. They consist of polished brass rods, in pairs, about three inches apart and extending

FIG. 8.—ORNAMENTAL PORTABLE.

from crossbeam to crossbeam. These crossbeams are not shown in the engraving. There are eight pairs between each crossbeam constituting a "row," which is connected to the main conductors separately. There are six such rows, each of which can be lighted separately by manipulating its switch, conveniently placed on the side wall. Each bracket is provided at its upper end with a T-shaped device, the arms of which are insulated from each other and serve to receive the current from the rods when the fixture is hooked upon them. The wires leading to the chandelier lights are connected to these arms. This arrangement is very convenient. Persons who are inspecting fixtures to make selections can have any fixture they please hooked upon these conductors and tried on a circuit either alone or with other lights.

If the view is inviting even as one enters the show-room and gazes at these beautiful appliances by the light of day, it can be easily conceived that it becomess far more attractive when one can see them illuminated by a light of their own. Not only is every fancy of the artist exhausted in the designs, but every resource of the metal-worker's skill is applied, and every suggestion of the glass-blower's art is borrowed in executing them. The light peeps out through colored glass and crystal pendant, as if it were but a means of bringing out the beauties of the latter.

FIG. 9.—ORNAMENTAL REFLECTING SUNLIGHT, SUSPENDED.

Again, one sees hanging vases with richest flowers, that seem to rival in freshness and gorgeousness those of the florist's conservatory, and amid the beautiful buds and blossoms one sees blooming tulips of glass all aglow with golden light, emitted within them by Edison lamps. Surely these are bouquets which are even more beautiful than those which Nature herself can supply. They are decorative and ornamental *par excellence*, even while they are useful. The spectacle produced as each row was in turn bathed in variegated light and made to display its finery of designs and materials can scarcely be described. The effect produced is far more pleasing to the eye than any extravaganza can reproduce on the stage. One could easily spend a whole day in admiring design after design, and we venture to submit that after all it is a difficult matter to select where there are so many beautiful objects. It is needless to say that there are fixtures for every purpose to which the incandescent light can be applied, and to suit all tastes and all prices. Their comparison is interesting on many accounts, for it reveals a kind of evolution. The plain bracket shown in Fig. 8, for instance, may be looked upon as a "first stage," which represents a time and conditions where the fact that the incandescent light will burn in any position is not recognized. So in order to satisfy conservatism the bracket retains the appearance of a plain gas bracket. Neither is it alone, for there are many styles and designs in the show room. In Fig. 4 we find conservatism assuming another shape, in the combination of the gas fixture with the lamp fixture, a combination which is to be found embodied in many styles and designs also.

There are many beautiful things which ought to find a place in our description did we have the space at our command. We must be content to point out a few which we illustrate herewith, not that they are selected for their more beautiful appearance, but because they represent original and interesting applications of the incandescent light as a factor in decorative and ornamentive art.

Fig. 5 shows a cluster globe for street or show window display, which is very effective. Fig. 6 shows an ornamental sconce with bevelled mirror, encased in polished *repoussé* or beaten gold mounted on blue plush. We cannot conceive of a more elegant application of the incandescent light to a drawing-room or cabinet. Fig. 7 is a four-light bouquet standard, in hammered brass, which is artistic in the extreme. The glitter of the polished brass under the mellow light of the lamps in the glass flower bulbs contributes a diffused warm glow which needs must make an apartment cheerful of itself. Messrs. Bergmann & Co. have been very successful in this style of *repoussé* work, judging by the unique specimens of large chandeliers of this kind with which the show-room abounds. Our large engraving presents a whole panel of *repoussé* on the wall at the background. This deserves special mention as a most unique object. It consists of an open lattice work covered with a bed of hammered flowers, through which are interspersed glass flowers and tulips containing

(*Continued on page* 280.

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Silicon-Bronze Wire.

Although telegraph companies have generally settled upon the use of iron wire, either plain or galvanized, for the construction of their lines, it does not follow that the question of choice is definitely settled. Indeed, iron wire only holds the first place *pro tempore*, until something better is found, for it is far from answering all the requirements. Electrically considered, the best wire is that which affords the best conductivity, or the least resistance for any given gauge. The use of a conductor of low resistance is equivalent to a reduction of the distance, since distance, electrically speaking, is but a matter of resistance. In this light, copper is the best material for making wire, because its specific resistance is lower than that of any of the common metals. But it is lacking in two important respects, tensile strength and, above all, cheapness. Copper wire has a specific resistance about seven times lower than iron, and for a line of the same resistance as with iron wire, a copper wire of a much smaller diameter could be used. But as copper is very ductile, it stretches and breaks more easily than iron wire of the same size, in the first place, and consequently a smaller copper wire would not be strong enough to withstand the strains from wind and other causes that telegraph lines are subjected to. Iron wire is therefore preferable on this score, as well as on that of cost. A greater tensile strength than that possessed by iron wire would, however, be preferable, specially where long spans are made necessary, as in stringing the lines over housetops or in crossing streams. Steel wire possesses increased tensile strength, but it is more brittle and possesses a higher specific resistance. For telephone lines in city and suburban circuits this increased resistance does not constitute a very material objection, because the increased line resistance which results is not perceptible on circuits whose total length is comparatively short. Phosphor-bronze wire possesses a still higher tensile strength, and even though it has a high specific resistance it would prove applicable for telephone lines, for which it has indeed been already used with success. With steel and phosphor-bronze wire the distance between the poles may be increased, owing to their greater tensile strength, and this is an advantage. For telegraph purposes, however, the diameter of wires made of these materials would have to be increased in order to keep the line resistance the same, and this would make the wire costly and difficult to run. The compound wire of the Postal Telegraph Company is the result of the desire to combine the electrical conductivity of copper with the tensile strength of steel, which, as we know, constitutes the core.

There is a great irresistible enemy to iron and steel, however, which constantly threatens the life of telegraph and telephone lines, and which is the cause of much worriment to telegraph engineers. This enemy is rust. The wire may be galvanized, and thus, for a time, bar out the corroding oxygen of the atmosphere, but sooner or later the latter asserts itself. It begins at the joints, and its action there increases the line resistance to an enormous degree. We have seen a common twist-joint give a resistance ranging up in the hundreds of ohms when rusted. This was the result of exceptional conditions, presumably. But let us admit that the resistance at each joint be only moderately increased. This increase, multiplied by the number of such joints, on a line of a hundred miles or more, amounts to something. It may mean that several additional cups of battery must be used, This observation, which we submit *en passant*, emphasizes the utility of *soldered joints*. Ultimately the line will succumb to the influence of rust, and then begin the troubles of the repairer. The expense attending the successive repairs of an old line makes an important addition to the original cost.

With the object of producing wire free from the defects pointed out above, experiments have been made in Europe with a new alloy, *silicon-bronze*, and the results have proved satisfactory enough to lead to the adoption of silicon-bronze wire by several governments. Silicon-bronze combines the two desiderata of low resistance, in which respect it approaches copper, and high tensile strength which is superior to that of iron. The tensile strength of silicon-bronze depends on the percentage of silicon, and strangely enough the specific resistance varies in direct ratio with the tensile strength. For telegraph purposes, the alloy may be such as will secure a comparatively low resistance with moderate resistance, while for telephone lines, where resistance is more immaterial, the alloy may be such as to have a high tensile strength with higher resistance. The following table from *L'Electricité* shows the comparison between these two alloys and their relation to copper, galvanized iron and steel:

NATURE OF WIRE.	Breaking strain per square millimetre.	Electrical resistance per kilometre.	Relative conductivity.
	Kilog.	Ohms.	
Pure copper	28	20.57	100
Silicon-bronze (for telegraph lines)	45	21.42	96
Silicon-bronze (for telephone lines)	76	64 00	34
Galvanized iron	36	135.20	16
Steel	42	166.80	12

It is seen that as regards tensile strength, the weaker of the two, the telegraph alloy, is yet superior to steel. The telephone alloy is over twice as strong as galvanized iron. So far as conductivity is concerned, the first alloy is but little inferior to copper, while the second is yet over twice higher than iron.

It is plain that for a line of the same resistance, this wire would have a tensile strength much greater, while for a line of the same tensile strength it would have a resistance many times lower. We may also assert that for a required resistance and a given tensile strength the diameter of the wire may be very much smaller than with galvanized iron or steel. The advantage of this reduction of diameter is quite great. Not only does it diminish the static induction and thus increase the working capacity of the line, but it leaves less chance for the straining action of the wind. Another important quality ascribed to silicon-bronze wire is its lightness. For telegraph lines in Europe the galvanized iron wire, weighing 155 kilogrammes per kilometre, is replaced by silicon-bronze wire weighing only 28 kilogrammes, and for telephone lines the steel wire weighing 25 kilogrammes is replaced by silicon-bronze wire weighing 8.45 kilogrammes. Of course a part of this reduction is due to the smaller size required, but a great portion of it is due to the lighter specific gravity of silicon-bronze. Thus, while the wire may cost more per pound, its use may prove as cheap, because less of it is required. The cost of transportation is also reduced. But there is one point on which it promises still greater economy. Unlike iron or steel, silicon-bronze will not rust. It becomes oxidized on the surface like many metals, copper, lead, tin, zinc, etc., but the action proceeds no further. These advantages seem to predict for silicium-bronze wire an extended sphere of usefulness, and one of our French contemporaries, the *Bulletin de la Compagnie Internationale des Téléphones*, having noticed the fact that this wire has received as yet little or no attention on the American side of the Atlantic, very pertinently calls attention to its merits in a brief article "To Our American Friends," which states that among other governments France, Belgium and Switzerland, have tried and adopted silicon-bronze wire for their telegraph lines, and that many private companies have followed the example, among which are the "Société générale française des téléphones" and the "Société générale Italienne des téléphones," the latter of which has replaced all the old wires on its lines by silicon-bronze wires. By way of conclusion let us quote the last paragraph:

"In the United States the extension of aerial lines is enormously great. The Americans, who have sent us so many useful and practical discoveries, have not yet tried this new wire. We think, therefore, that we ought to recommend it to them, and we believe that, without lowering their dignity, they can for once perchance adopt a good invention sent them from old Europe."

The Aerial Wire Question.

Following closely upon our own treatment of the attacks made on the stringing of arc light and other electric wires overhead an able letter appeared in the New York *Times*, from Prof. Henry Morton on the same subject. His arguments for, and confirmation of, the opinions we expressed are welcome, coming from an authority so high; although we do not well see how anything else could have been expected from one acquainted, as he is, with the merits of the question.

Prof. Morton's letter is a careful and able survey of electric lighting in this city, and it is also an exposure of the attacks made upon the arc systems of lighting as operated by means of aerial wires. Taking the facts as we found them, he shows that the loss of life and property has been most wildly, wilfully and absurdly exaggerated. The Professor scores a new point, too, when he says: "The insignificant amount of the damage and its distribution among the systems is remarkable. Both are largely explained by the fact that fire caused by such means, especially with the aerial conductors, *is sure to be at once noticed* and promptly suppressed. Where the conductors enter buildings under ground defects in insulation are not so conspicuous." The conclusion he arrives at as to the whole matter is that which is forced upon any thoughtful mind, namely, "that this new agent of illumination is very much safer than any of the old ones it replaces even under the disadvantages of novelty and first introduction." As to the underground system, where interior uses of the light are concerned, it is manifestly not to be preferred, he says, and as to out-door applications, there is really no first choice on the ground of safety; while the practical effect of underground systems is, at present, to deprive people of the use of the light. In Paris, the expense of illuminating by means of electricity, with the conductors all run under ground, has been seriously detrimental to the commercial success of the companies; and the same is in a degree true of London. It is a well known fact that the local ordinances in Chicago, St. Louis and Milwaukee, compelling conductors to be laid under ground, have obstructed the development of street illumination by electricity in those cities. In reply to a recent inquiry of ours, a correspondent in Chicago stated that at the time of writing, the total number of arc lights in all that city, rented or not, was Brush, 138; United States, 113; Van Depoele, 283; Fuller, 112; Excelsior, 40; Sperry, 8. Chicago would show a much better record than that if the conditions were more favorable.

But, after all, the number of aerial arc light wires in New York is very small indeed, as compared with the number of telegraph and telephone wires. Hence, as Prof. Morton argues, the plea of danger being dismissed, the only other requirement, that of beauty, would not be filled by driving the arc light wires under ground. The aerial network would to all appearance remain as minutely reticulated as before. Now, we do not think that the public is particularly anxious to have all the wires put under ground. Everybody admits that the wires are not an æsthetic feature, but they who wage war on the overhead wires are very few in number and entertain the most Utopian ideas. The utter lack of practicality is exemplified in the resolution offered at the last meeting of the Brooklyn Board of Aldermen by a member calling

upon all the telegraph companies to put their wires under ground by the 1st of May next!

The charges made against the aerial wires are grossly untrue in the majority of instances, and it may be thought well to pass them over in silence, leaving them to the refutation of time and experience; but our own view of the matter has been that it paid better to enlighten the public and to run these wild statements in the press down, showing their improbability and want of foundation. The action of the Board of Aldermen on Wednesday is confirmatory of our opinion. In the exercise of their power and wisdom the Board have adopted an ordinance compelling the electric light companies to put their wires under ground within two years. At first it was proposed to make the reprieve six months only, but that was evidently too absurd for consideration. As there is a general ordinance forbidding the tearing up of the streets in winter, the time of grace really dates from next May. So far the action of the Aldermen has had no bad effect on electric light stocks, and the companies interested treat the matter with the utmost coolness and composure. A great deal can be done, and a great deal may happen in two years and a half. Any good schemes of undergrounding the wires now have their opportunity.

Compliments of the Season.

We take with pleasure this opportunity of wishing our thousands of readers the compliments of the season, and after the support and encouragement they have so cordially given us during 1883, we could not but desire for them in the heartiest manner a Merry Christmas and a Happy New Year. For Christmas leisure we have endeavored to provide a number of even more than usual interest and value, dealing as it does with the progress of American electrical manufacturing, the aims of the Philadelphia Electrical Exhibition of 1884, and underground wires, the great question of the hour. During the year to come we shall show that the large promise and performance of THE ELECTRICAL WORLD in 1883 will be fulfilled and excelled, and that no means will be lost to keep the journal absolutely indispensable to all interested in electrical matters.

Underground Wires in New York.

The Finance Committee resumed consideration on the afternoon of the 17th of the resolution of the Board of Aldermen of this city directing that inquiry be made into the nature and extent of danger to life and damage to property incident to the present system of stringing on poles the wires of the electric light companies, and also to ascertain how the alleged evil could be best remedied. At a former meeting of the Board the committee made a report setting forth that the wires, as they are now strung up, are a menace to life and limb and dangerous to property, and recommending that an ordinance be passed compelling the electric companies to remove their poles and place the wires under ground. Consideration of this report and resolution was postponed until the committee could further investigate the subject.

The committee listened first to statements by Professor Henry Morton, of the Stevens Institute, Hoboken, who appeared as chairman of a committee agreed upon by the different electric light companies in this city as to the best method of underground insulation for wires, and Vice-President Rowley and Superintendent McGrath, of the Brush, and President Lynch and Secretary Curtis, of the United States electric light companies. Professor Morton reiterated his recently published views to the effect that the danger from electric wires was more imaginary than real in New York, and that as yet he had not seen any method—such as boxes, cylinders or troughs—for laying wires under ground that would be successful or practicable. In his opinion the only underground substitute for the present pole system was to be had in sub-ways, constructed so as to protect and preserve the insulation of the wires and large enough for a workman to enter in case the lines needed repair. He thought that in course of time the electric wires would have to be put underground, but that this could not be done until some practical plan had been devised for this purpose.

Vice-President Rowley, of the Brush Electric Lighting Company, testified that the only way in which the wires could be successfully placed under ground was to run them through large sewers or sub-ways, similar to those in Paris. The agitation against the present system was the work of interested persons who wished to promote their underground systems and float the stock of embryo organizations. This had been attempted in Philadelphia, and he wished to warn the committee that a similar thing would be attempted here. This was evinced by the articles which certain newspapers were printing favoring the underground plans. The Brush system differed somewhat from the Edison, but the latter has to be dug up and repaired frequently. As large a number as 3,000 lights have been reported to be out at one time.

W. H. McGrath, of the Brush Company, said it would be impossible to tell how long it would require to place the wires under ground, as no system has been invented by which that work can be done successfully. A few circuits might be placed under ground in two years, but if an ordinance is passed requiring every company to place its wires under ground within six months all would be obliged to shut off their light.

L. E. Curtis of the United States Electric Lighting Company corroborated the statements of Mr. McGrath. The only feasible plan would be to construct a large tunnel which would hold all the electric wires and enable repairs to be made at any point.

There was a large attendance of persons interested in electric lighting, in the chamber of the Board of Aldermen on Wednesday, the proposition for placing the wires underground being under consideration. The Finance Committee reported an ordinance making it compulsory on the part of the electric light companies to place their wires below the surface within two years, instead of six months, as at first proposed.

A communication from the Board of Health reported that within three years there had been one death by shock from an electric current and two deaths from falls from platforms.

The question of delay was decided adversely by a vote of 18 to 6. Alderman O'Connor then proposed to send the report back to the Finance Committee with instructions to make a comprehensive report providing for the placing of telegraph and telephone wires under ground, as well as the electric light wires. To this proposition Alderman O'Neil, Chairman of the Finance Committee, objected, on the ground that the representatives of the electric light companies desired to have their interest stand alone and not to have it involved with that of the telegraph companies.

Alderman O'Connor said he had presumed that the Board of Aldermen was legislating in the interest of the citizens, and not in that of the companies. The amendment of Alderman O'Connor was defeated, and the ordinance was then adopted.

A Practical Demonstration of Their Safety.

Now that so much is said about the danger of electric light wires, a public service is done by any one who will show that the various charges of the kind made are without foundation. Experiments in this direction were made on the 18th by Mr. L. E. Curtis, Secretary of the U. S. Electric Lighting Co., of this city, at the factory of the company in Newark, N. J., in the presence of a number of electricians. In the adjusting room of the factory, where forty Weston arc lights are continually being tested, and where almost the full force of the dynamo machines is in use, the positive and negative wires of the machines were both grasped by gentlemen without any annoying results. The shock was strong, but not severe, the current being continuous. At the further end of the circuit, after the entire number of lights had been fed from the force, the shock was trifling. At the point where the wires entered the room freshly charged by the machine, the shock was more severe, but even then not of sufficient strength to injure a person in the least. Another interesting experiment was tried. A telephone wire on a working circuit was laid across two uninsulated electric light wires, conducting through it the entire strength of the circuit. This was handled by the visitors with perfect impunity and with the utmost freedom from danger. This wire was also touched to wood and other inflammable materials without exciting even so much as a single spark. During the evening an alarm was rung from the Newark Fire Department Headquarters, and a stream of water was thrown upon both the positive and negative wires of the lines which furnish the lights in that city, without the person directing the stream experiencing any electrical sensations whatever. "The only occasions," said Mr. Curtis, "when any lives have been lost with any electric light lines, and they have not been with our company in a single instance, have been those of linemen who have been careless in handling the wires. I have never heard of a single outsider being injured by electric light lines except in the case of a Buffalo man who deliberately committed suicide by walking into a light station and catching hold of the two binding posts of the dynamo machine. He was instantly shocked to death."

Telephone Patent Litigation.

The impending legal struggle between the American Bell Telephone Co. and the Overland Co. was referred to recently in these columns, when we published the first news given as to the proceedings in New Jersey and Pennsylvania. The subjoined statement, dated 12th inst., now comes from Harrisburg, Pa., with regard to the progress of the suit: "A short time since the Bell Telephone Company applied in the Circuit Court of New Jersey at Trenton for a preliminary injunction against the Overland Telephone Company, to restrain the latter from using the Baxter patent, which is said to be an improvement upon the telephones now in use. The Bell company alleges that the Baxter improvement is to be applied to the Bell telephone, thus making an infringement upon the latter's patent. The case was before the court last week, at which time the judge refused to grant the injunction, and gave the Overland company 10 days' further time to take and present affidavits favorable to its side. The Overland company, through its attorneys in this city, have been engaged since last Friday in taking affidavits in support of its case. The Overland company contends that Bell was not entitled to a patent for his telephone, because Daniel Drawbaugh, of Cumberland county, discovered and put into practical operation a telephone long before the time at which Bell avers he invented his telephone. The affidavits taken are mostly those of the persons who were witnesses on behalf of Drawbaugh in the suit pending between the People's and the Bell companies. The line of argument will probably be that, as Drawbaugh first invented the telephone, Bell was not entitled to a patent upon it, and that consequently, even admitting that the Baxter improvement is to be applied to the Bell telephone, there can be no infringement of Bell's patent, because Bell was not entitled to a patent."

It is now reported that negotiations are going on between the People's Co. and the American Bell Co.

Threats of Cutting the Wires.

A Mr. Edward Kearny, of 265 Broadway, gave notice by advertisement in the daily papers about a week ago that if the telegraph companies did not remove all their wires from the roof of 482 Sixth avenue, corner of Twenty-ninth street, the wires would be cut. Up to the present time, however, he has not carried out his terrible threat. He says he is waiting for a change in the weather. Supt. W. C. Humstone, of the Western Union Co., states that the wires do not belong to the company, and General Manager W. H. Eckert, of the Metropolitan Telephone Co., has ascertained that the wires are none of his. It has been suggested that probably the obnoxious lines belong to the American District Messenger Co. Mr. W. H. Schutt, acting superintendent of that company, says: "There are, I should think, very nearly 5,000 miles of house-top wires in this city. Down town, where the wires are the thickest, a man can almost walk on them as he would on a pavement. We always pay for the privilege of putting a wire on a man's house, and the permission is absolutely necessary for us. If the people want the district service they must allow the wires to be put on their roofs. How else could we reach houses in the centre of blocks? We always pay attention to complaints whenever any are made. Our linemen are instructed never to go on a man's roof unless they have permission, and a sharp workman will get around a building, nine times out of ten, without infringing on any one's rights. Of course, we have no right to invade a man's premises. He can give a reasonable notice and cut our wires if they are there contrary to his wishes."

It is noticeable that with 5,000 miles of wires in every direction overhead, only one man thus makes himself conspicuous by complaint of them. In Brooklyn a few property owners on Court street have given notice by advertisement that the wires stretched over their houses are a nuisance, and that "said nuisance must be abated and moved without further notice." Reports with respect to the abatement appear to be unaccountably delayed in publication.

The Trusteeship of the Bear Patents.

Mr. Simeon J. M. Bear is known as an inventor of devices for the conveyance of intelligence by electricity. In the Autumn of 1878 he and other inventors pooled their patents and put them into the possession of Daniel H. Craig and Horatio G. Angle, as trustees. These trustees bought certain other privileges and took in Thomas Wallace as their co-trustee. Wallace was one of the three incorporators of the American Rapid Telegraph Company. He and his fellow-incorporators bought from Craig, Angle, and himself all the rights, privileges, etc., held by the latter three as trustees, agreeing to give for them 20,000 shares of American Rapid stock. They then sold the property to the American Rapid Telegraph Company for its entire capital stock of $3,000,000, represented by 30,000 shares of a par value of $100. After that company had been formally organized, it made a certificate for 20,000 shares of its stock to be delivered to Trustees Craig, Angle and Wallace for distribution among the beneficiaries under their trust. This certificate was not delivered, but, it is said, was canceled, with the assent and connivance of the trustees. Mr. Bear, on behalf of himself and other beneficiaries, sued their trustees and the American Rapid Telegraph Company.

Judge Macomber, holding Supreme Court, Special Term, decided on the 13th that Trustees Craig and Wallace—Angle being now dead—had not carried out their trust, and must be removed from their posts, and that the American Rapid Telegraph Company shall pay over to their successors 20,000 of its shares, to be divided among Bear and the other beneficiaries under the trust.

MEXICAN TELEPHONE INTERESTS.—A dispatch from the city of Mexico says: A concession for an opposition telephone company in the federal district has been granted to Juan Gutierrez, a friend of Messrs. Delano and Haines. As it would be hopeless to institute another exchange it is believed that this movement and that of the Mexican Central Telephone Company are simply intended to make trouble for the Mexican Telephone Company. The latter holds until April 12 the rights reported as acquired from the former military districts.

A Representative American Electrical Manufactory.

(*Continued from page 277.*)

lamps of very bright colors. The effect produced when this is lighted is grand. It seems like an arbor covered with golden vines and blooming with morning-glories. These panel pieces can be applied to ceilings as well as to walls and prove very desirable where the ceilings are not high enough to receive large chandeliers.

Fig. 8 is an ornamental reading lamp, of which the firm make many varieties. Fig. 9 is an ornamental "reflecting sunlight," very rich and tasty in design. The number of lights around the canopy may be varied from 6 to 16 and inside the reflector from 6 to 60, according to the size of the fixture. Our large engraving shows another form of reflectors of this description in old gold and cut glass which is very rich. There are also a number of designs of chandeliers with prism reflectors, and among these some beautiful sunlights for theatres. Among the interesting novelties we should mention a "fish globe" fixture, in which the lamps are submerged in a fish globe suspended by an artistic fixture. The heat evolved by the lamps is so trifling that it does not annoy the fishes in the least. A fixture with lowering light is also worth mention.

The show-counter in the centre of the show-room is covered with a whole *bric-à-brac* of novelties. Pedestals with reflectors—some of these reflectors are of polished metal and others are of porcelain. Some are parabolic, intended to project a beam in one direction, for use on theatres, ships, etc. Others are simply conical or concave, and merely disperse the rays of lights. There is a variety of foot-light appliances for theatres, guarded lamps, with corrugated tin reflectors for steamship berths, and

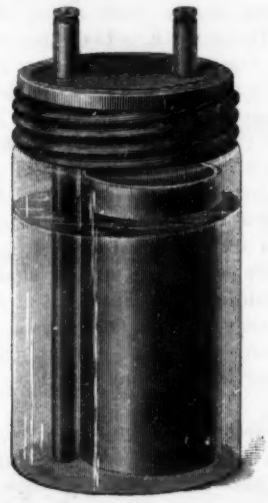


FIG. 10.—BERGMANN AND HAID BATTERY.

even head-light and side lanterns. There was even a common house lantern containing an Edison lamp, to which the current was conveyed by a long flexible cord. By way of demonstration of the advantages of this electric lantern, it was thrown down on the floor and even kicked, and yet it continued to burn brightly.

An oil lantern, specially one using kerosene oil, would have likely resented such rough treatment by exploding.

One of the most novel applications of incandescent lights to the decoration of show windows consisted in a flash light standard. This was a bouquet of hammered brass carrying four lights of bright contrasting colors, namely, purple, blue, red and green. On either side was a pedestal light, one giving a white pink light and the other a light green light. The current supplying these lamps actuated by a derivation a small motor placed under the counter. This motor worked a commutator by which the current was transferred alternately from one pair of lamps to another, and thus flashes of variegated hue were constantly reproduced. The small umbrella-shaped canopy fixture shown near the ceiling in our large engraving is also intended for shop window or shop entrance decoration.

We have not space to follow further our description of the beautiful objects to be seen in this exhibition, which shows, better than imagination could picture it, the capabilities of the incandescent light as a factor of decoration and ornamentation. We have said and shown enough of them, however, to vindicate the reputation of American manufacturers for taste and skill. The incandescent light is a good theme for the designer and the artisan—a theme which inspires rather than restricts the search after new forms and combinations, suggesting applications that could not be thought of in illumination by gas—and we are glad to find that it is being studied as earnestly and as successfully on this side of the Atlantic as on the other.

ELECTRIC MOTORS IN AERONAUTICS.—In a communication to the *Aéronaute*, President D. Napoli, of La Société de Navigation Aérienne, compares the weight of steam engines and electric motors for use in aeronautics. For ten hours' work the weight of fuel and water required for the engine would be about 3,527 lbs., taking it at 20 h. p., whereas the weight of the motor and its supplies would only be about 3,087 lbs. Then the weight of the engine itself, which may be anywhere from 250 to 400 per cent. heavier than its supplies, has to be considered as well.

The International Electrical Exhibition.

Great interest is already shown in the International Electrical Exhibition which is to be held at Philadelphia in September, 1884, under the auspices of the Franklin Institute of that city. As we have already announced, Congress has given it official recognition, and permission has been granted for the importation of articles for exhibition free of duty. Preparations are already being made by electricians, inventors and capitalists in this country and Canada to show to the best advantage any and all inventions and applications with which they are connected, and it is expected that some interesting electrical apparatus will be sent from Europe.

We take pleasure in presenting to our readers, in this issue, the general classification of the proposed exhibits. It is a masterly piece of work, reflecting great credit on those who took the trouble to arrange it; and it ought to be accepted as a perfect nomenclatory survey of the whole field of electrical science. We can but hope that the exhibition will fill up this outline in a manner more than satisfactory to its organizers, doing honor not only to them and to this country, but advancing the interests of electricity as they have never been advanced before. With the brilliant examples of Paris, London, Munich, and Vienna before us as incentives, no effort should be spared to render the exhibition perfect and the occasion memorable.

Section I. Production of Electricity.—Class I. Apparatus for Electricity of High Electromotive Force. (1.) Frictional Electrical Machines. Electrostatic Induction Machines (Holtz, Töppler-Holtz, etc.) Electrophores, Leyden Jars and Condensers. (2.) Induction Coils. Hydro-Electric Apparatus. Geissler Tubes. Class II. Voltaic Electric Apparatus.—Voltaic Batteries (Single and Double Fluid.) Gravity. Constant. Gas Batteries. Dry Piles. Battery Accessories (Elements, Couples, Exciting Liquids for Batteries, Porous Cells, Battery Jars, Binding Posts and Clamps, Devices for Maintaining Constancy of Batteries, Devices for Coupling Batteries) Class III. Thermo-Electric Apparatus.—Thermo-Electric Batteries. Class IV. Magneto-Electric Apparatus. Machines for Blasting, etc. Exploders. Machines for Testing Circuits. Class V. Dynamo-Electric Apparatus.—Dynamo-Electric Machines and Accessories. Direct and Alternating Currents. Arc Light Machines. Incandescent Light Machines. Plating Machines. Telegraphic Machines. Field Magnets. Arrangement and Disposition of Field. Series-wound Magnets. Shunt-wound Magnets. Shunt and Series-wound Magnets. Multiple Coil-wound Magnets. Magnet Cores, Construction and Ventilation of. Pole Pieces, Shape and Proportions of. Armatures. Construction of Cores. Devices for Ventilating or Cooling Cores. For Preventing Induction Currents in Armatures. Insulation of Cores. Arrangement of Armature Coils. Connection of Armature Coils. Ventilation of Armature Coils. Commutators.—Disposition of Commutator Segments. Insulation of Segments. Devices to Avoid Short-Circuiting of Commutators. For Automatically Oiling Commutators. For Removing Wearing Segments of Commutators. For Avoiding Sparks in Commutators. Air-blast Attachment for Commutators. Brushes or Collectors.—Construction. Devices for Controlling Position of Brushes. Automatic Electric Governors for Brushes. Non-Automatic Governors for Brushes. Machine Bearings.—Journals, Boxes, Oil-cups. Devices for Preventing Heating of Shafts. Special Devices for Dynamo-Electric Machines.—Devices for Turning out Lights. For Changing Character of Current Furnished by Machine. For Preventing Injurious Effects of Short-Circuiting of Machines. Class VI. Mechanical Motors.—Steam, Gas, Water, Heat and Wind Engines.

Section II. Electric Conductors.—Class 1, Telegraph Wires.—Poles, Insulators, Cleats, Material and Tools employed. Class 2, Telephone Wires and Cables.—Devices for Avoiding Effects of Induction in Telephone Wires. For Decreasing Space Occupied by Telephone Wires. Erecting of Telephone Circuits. Materials and Tools Employed. Class 3. Electric Light Circuits.—Devices for Erection, Maintenance, and Insulation. Class 4. Underground Conduits for Electric Conductors.—Devices for Avoiding Injurious Induction in, or by, Conductors. For Laying Wires in Conduits. For Removing Wires from Conduits. For Carrying out Loops from Conduits. Subways for Electric Conductors. Class 5. Sub-Marine Cables.—Construction of Cables. Apparatus for Laying Cables. Class 6. Insulating Materials for Conductors.—Methods of Applying Insulating Material. Braiding Machines. Machines for Wrapping Wires. Apparatus for Manufacture of Cables. Class 7. Electrical Joints and Connections.

Section III.—Measurements.—Class I. Measurements of Dimensions.—Standards and Gauges. Class II. Measurements of Speed, Force and Energy.—Speed Counters. Pressure Indicators. Dynamometers, Absorption and Transmission (Differential, Belt, Spring, Scale or Balanced Lever). Calorimeters. Class III. Electrical Measurements.—Resistance—Resistance Coils (Rheostats, Shunts and Bridges). Electromotive Force—Standard Cells, Electroscopes, Electrometers. Current—Galvanometers and Multipliers. Electro-Dynamometers. Capacity—Standard Condensers. Induction Balances. Commercial Galvanometers—Ohmmeters. Voltmeters. Ampèremeters. Coulombmeters. Accessory Apparatus—Keys for Change of Polarity. Keys for Timing, Discharge, etc. Class IV. Photometric Measurements.—Photometers (Shadow, Disc, Dispersion), Standard Candles, Balometers, Carcel Lamps.

Section IV.—A. Applications of Electricity. Apparatus Requiring Electric Currents of Comparatively Low Power.—Class I. Electric Telegraph.—Morse System. Duplex. Quadruplex. Multiplex. Harmonic. Needle. Recording. Autographic. Printing. Relays. Repeaters. Cut-Outs. Switch Boards. Lightning Arresters. Pole Changers. Class II. Apparatus for the Electrical Transmission of Sound.—Telephones and Microphones. Transmitters.—By varying Electrical Resistance. Microphone Transmitters. Metallic Powder Transmitters. Solid Contacts. Solid and Liquid Contacts. Magneto-Electric Transmitters. Electro-Magnetic Transmitters. Thermo-Electric Transmitters. Electro-Static. Receivers.—Microphonic Receivers. Electro-Magnetic Receivers. Electro-Motographic Receivers. Electro-Static Receivers. Apparatus for Central Stations. Automatic Exchange Systems for Telephonic Communications. Electro-Magnetic Call Bells and Signals for Telephones. Devices for Maintaining the Secrecy of Telephonic Dispatches. Telephonic Relays. Repeaters and Transmitters. Protection against Lightning and other Injurious Electric Currents. Photophones and Radiaphones. Class III. Fire and Burglar Alarms.—Class IV. Annunciators.—Class V. Electric Clocks and Time Telegraphs.—Electrical Devices for Setting Hands. Moving Hands. Regulating Clocks. Striking Clocks. Winding Clocks. Electric Time Locks. Class VI. Electrical Registering Apparatus.—Chronographs. Apparatus for Counting, Recording or Registering Votes. Fares. Sheets in Printing. Gallons of Water Pumped. Temperature. Pressure. Rain Fall. Time. Course and Velocity of Ships. Speed of Railway Trains. Deep Sea Soundings. Velocity of Streams, etc., etc. Class VII. Electric Signal Apparatus.—Signals for Railroads. Block Systems. Automatic Electric Railway Signals. Street Crossings at Grade. Signals for Height of Water in Boilers. For Testing Air in Mines. For Temperature. Thermostats. Electrical Steam Whistles. Other Signals. Class VIII. Electro-Medical.—Voltaic Induction or Faradic Apparatus. Voltaic or Galvanic Battery Apparatus. Töppler-Holtz Machine, or Franklinic Appliances. Thermo-Electric Appliances. Medical Electrodes (Laryngeal, Aural, Urethral, Sponge, etc.) Chain Piles. Electro-Cautery or Galvano-Cautery Apparatus. Electrolytic Needles. Electric Probes and Explorers. Induction Balances for Surgical Explorations. Electric Illuminators for Medical Explorations. Class IX. Applications of Electricity to Dentistry. Class X. Applications of Electricity to Warfare.—Torpedoes. Electric Signals for Gunnery. Firing Guns by Electricity. Electric Targets. Class XI. Applications of Electricity to Mining and Blasting. Class XII. Applications of Electricity to Spinning and Weaving. Class XIII. Electric Traps and Snares.—Traps for Animals. For Birds. For Fish. Class XIV. Applications of Electricity to Pneumatic Apparatus. Class XV. Applications of Electricity to Musical Instruments.—Electrical Organs. Class XVI. Applications of Electricity to Writing and Printing.—Electrical Pens. Type-Setting Machinery. Class XVII. Electrical Toys. Class XVIII. Electrical Conjuring Apparatus. Class XIX. Miscellaneous Applications of Small Currents.

Section IV.—B. Applications of Electricity.—Apparatus Requiring Electric Currents of High Power. Class I. Electric Illumination.—Arc and Incandescent Lighting. Arrangement and Distribution of Circuits.—Insulation of Circuit. Safety Devices in Circuits. Switch-Boards. Devices for Hanging Lamps. Chandeliers and Brackets for Electric Burners. Arc-Lighting Lamps. Switches on Lamps, Automatic and Hand. Direct and Shunt Magnets in Lamps. Clutches for Holding Carbon Rods. Dash Pots for Lamps. Devices for Preventing Vibration of Lamps. Carbon Holders. Devices for Securing a Proper Alignment of Carbons. Devices for Moving Globes to Secure Facility of Introducing Carbons. Automatic Cut-out Devices for Preserving Continuity of Circuits. Double Carbon Lamps. Multiple Carbon Lamps. Jablochkoff Candles. Lamp Frames. Devices for Insulation of Frames. Focussing Lamps. Globes and Shades for Lamps. General Construction and Shape of. Transparency, or Translucency of. Lamp Hoods.—For Protection against Weather or Fire. Mirrors and Reflectors for Arc Lights. Carbons for Arc Lighting. — Materials Employed for Carbons. Grinding Apparatus for Carbons. Hydraulic Presses used in Manufacturing Carbons. Ovens Used in Baking and Re-baking Carbons. Processes for Electro-Plating Carbons. Incandescent Lighting.—Carbon Filaments for Electric Lights. Preparations of Material for Filaments. Substances Used for Filaments. Preparation of Incandescing Filaments.—Methods Employed for Carbonization. For Driving-off Occluded Gases. For Insuring Uniformity of Electrical Resistance. Electrical Testing of Filaments. Leading Wires.—How Cemented to Filament. How Secured to the Enclosing Glass Globes. Glass Globes for Incandescent Lamps.—Peculiarities of Construction; how Exhausted, Sealed and Protected against Leakage. Light-Houses.—Lamp Focussing. Flashing Lights. Fixed Lights. Apparatus for Removing Lamp Instantaneously. Dioptric Apparatus for Electric Light Plants. Sub-Marine Lighting. Applications to Sub-Marine Explorations, Fishing, etc. Electric Illumination of Buoys. Locomotive Head-Lights. Class II. Electro-Metallurgy —

Processes. Electrotyping. Copying and Duplication of Coins, Medallions, Works of Art, Natural Objects. Of Letter-Press; Engravings; Music, etc. Electro-Plating.—Electro-Deposition of Metals on Metals; on Ceramic Wares; on Textiles, Fabrics, etc. Galvanic Etching. Materials, Tools and Machinery Used in Electro-Metallurgy. Materials for Cleansing and Preparation.—Acids, Alkalies, various Scouring Agents. Materials for Molds.—Wax (and Compositions thereof), Plaster, Stearine, Fusible Alloys, Gutta Percha, Gelatin, and Compositions thereof. Materials for Lining Vats, etc. Stopping-off Varnishes. Materials for Deposition, Embracing Anodes.—Metallic Salts Used in Electrotyping and Electroplating. Alloys specially prepared to Deposit on. Materials for Finishing Electro-Coated Products.—For Coloring Electro-Gilded and Plated Wares; Gilders' Wax; Ormolu Colorings; Dead Lustre Mixtures, etc. Mechanical Appliances and Machinery.—Scratch-Brushes and Lathes-Cutting, Buffing and Polishing Wheels. Depositing Apparatus and Vats, Suspending Frames and Appliances for Keeping Goods in Motion, Plating Balances for Weighing Amount of Metal Deposited, Frames and Devices for Sectional Plating. Electrotyping Machinery, such as Molding Cases, Black-Leading Machines, Toggle and Hydraulic Moulding Presses, Building Irons and Furnaces, Case-Filling Tables, Backing Pans and Stands, Saw Tables, Planing and Shaving Machines, etc. Finished Products.—Electrotypes of Letter Press, Engravings, Music and other Materials to be used in Printing. Electrotypes of Coins, Medals, Artistic Objects. Electro-Gilded and Plated Wares of every description. Nickel-Plated Wares. Other Electro-Coated Products, exhibiting the Deposition of Brass and Bronzes, the Platinum Metals, other Metals not Enumerated. Printing Rollers. Textiles. Ceramic Wares, etc. Class III. Other Applications of Electro-Chemistry. Processes. Electrolytic Analysis.—Refining of Metals.—Treatment of Metallic Ores and Compounds on the Metallurgical Scale. Miscellaneous Applications to Chemical Technology, embracing the Subjects of Bleaching (Ozone) Nascent Hydrogen, Dyeing and Printing of Textiles, Food Products, including Wines and Liquors, etc.). Apparatus and Machinery. Finished Products of Electro-Chemistry. Class IV. Storage Batteries and Accumulators.—Varieties of Electrodes or Plates. Preparation of Electrodes. Methods of Charging Batteries. Secondary or Polarization Batteries. Class V. Electric Motors.—Transmission of Power.—Devices for Varying Speed. For Reversing Motion. For Increasing Power. Electro-Dynamic Railroads. Class VI. Electro-Magnetic Brakes. Class VII. Miscellaneous Applications of Large Currents.

Section V. Terrestrial Physics.—Class I. Atmospheric Electricity.—Apparatus for Measuring Atmospheric and Potential. Lightning Rods and Protectors; (a) for buildings, (b) for ships, (c) for oil tanks and powder magazines. Class II. Terrestrial Magnetism.—Specimens of Lode-Stone. Varieties of Permanent Magnets. Magnetic Needle and Compasses. Binnacles for Mariner's Compasses. Dipping Needles and Circles. Declination Theodolites. Magnetometers (Magnetic Torsion Balances). Class III. Apparatus Used by Governments for Weather Signal Stations.

Section VI. Historical Apparatus.—High Electromotive Force. Voltaic Electricity. Thermo Electricity. Magneto Electricity. Dynamo Electricity. Electric Telegraphs. Electric Motors. Electric Lighting Apparatus. Telephone, Microphone, Radiaphones and Photophones. Miscellaneous.

Section VII. Educational and Bibliographical. Class I. Educational Apparatus. Class II. Bibliographical.

Buffalo Electrical Society.

A large and interesting meeting was held by the Buffalo Electrical Society at their rooms, on the evening of the 7th inst. Mr. William Finn delivered an able and instructive lecture, illustrated as heretofore with drawings and suitable electrical apparatus, his theme being the laws governing electricity. He demonstrated the fact by theory and experiment that static electricity resides upon the outside of all conductors, and offered convincing proofs that residents in houses covered with a network of wires are exempt from danger from lightning. Heretofore the lecturer has merely shown and explained the presence of frictional electricity. On this occasion he illustrated and explained the methods used for determining its force by means of Coulomb's torsion balance. Additional apparatus is being procured as occasion demands and each successive meeting adds to the interest manifested.

THE TELEGRAPH.

M. J. H. OAKES has been appointed manager of the Canadian District Telegraph Company of Montreal.

CHOOSE YOUR OWN TIME.—St. John, N. B., has three time standards, with an hour's difference between the railway and telegraph clocks.

THE RUFUS HATCH SUITS.—The suits of Rufus Hatch against the Western Union, American Union, and Atlantic and Pacific Telegraph Companies and the directors of the Western Union Co. in the Superior Court, have been discontinued.

FOR THE SAKE OF CABINET HARMONY.—Some persons who pretend to know say that Postmaster-General Gresham is in favor of postal telegraphs, but that for the sake of harmony in the Cabinet he made the views expressed in his report coincide with those of the President's message. Pliancy of this kind is not shown in Judge Gresham's record.

WESTWARD THE POSTAL HOLDS ITS WAY.—News comes from St. Louis, Mo., that the Postal Telegraph Co. has stretched across the bed of the Mississippi a cable which connects it with the East. The company has nearly completed its line between that city and Chicago, and the assertion is repeated that it will begin operations at the beginning of the new year.

CARL SCHURZ AND THE "EVENING POST."—Mr. Carl Schurz has dissolved his editorial connection with the *Evening Post*. It is a well-known fact that his wishes and opinions were disregarded when that journal so zealously and so erratically espoused the cause of the telegraph companies against the strikers. The occasional articles in favor of the employés are attributable to his pen, and are gratefully remembered by the fraternity.

LIEUT. SWIFT'S BOOK.—This work has already met with remarkable success. We publish on page 288 a few opinions of the book received from those who have ordered copies. They show that "The Practical Telegrapher" is what its title indicates it to be—a thoroughly practical work, written by a practical telegrapher and teacher, in easy and simple language for practical men. It is undoubtedly a book that every American telegrapher should have.

THE INTERNATIONAL TELEGRAPH CO.—A dispatch of the 15th from Ottawa, Ont., says that the International Telegraph Company, of Toronto, have given notice that they will apply to Parliament for an act of incorporation, with power to construct and work telegraph and telephone lines throughout Canada and Canadian waters, with all necessary powers to buy, lease or amalgamate with any other telegraph or telephone company, and all other usual claims or privileges necessary for a company with such objects and purposes.

THE TELEPHONE.

THE SALE OF THE PIONEER CO.—We mentioned last week the sale of the Pioneer Co., which has had control of the Boston and Lowell extra-territorial business, with the New England Co., on the basis of one share of Pioneer stock for four of New England. The Boston *Herald* says: The Pioneer is a three-wire line between the cities mentioned, built in 1878, and doing a profitable business. Its capital was $7,200, and it was held by nine gentlemen, who had eight shares each. Several attempts have been made to purchase it, but without avail until the present. On the basis of 60 for New England stock the sellers realized 240 for Pioneer, and the original capital appreciates to $17,280.

THE TELEPHONE INTERFERENCE CASES.—A dispatch from Washington, of the 15th inst. says: The arguments by counsel for Voelker & Irwin, Alexander Graham Bell, Thomas A. Edison, Gray & McDonough, parties to the celebrated telephone interference cases which were begun on Tuesday last before the board of examiners-in-chief of the Patent Office were concluded to-day by Roscoe Conkling. The decision of the examiner of interference was, it will be remembered, in McDonough's favor in what are regarded as some of the most important claims in the telephonic patent. An appeal was made from this decision by Voelker & Irwin, Bell, Edison and Gray to the board of examiners-in-chief, who have spent the past week in listening to arguments by their counsel.

THE BLAKE TRANSMITTER.—The illustration and description of the Blake Transmitter, in the new book by Lieut. Swift, called "The Practical Telegrapher," and advertised elsewhere in this issue, are undoubtedly the clearest that have ever been published on this subject. An entire chapter of the book is devoted to the telephone—including instructions as to finding and removing troubles, construction of a telephone line, etc. Chapter II., on Batteries; Chapter III., on the Construction and Equipment of Lines; Chapter VI., on Submarine Cables; Chapter VIII., on Electrical Testing, and Chapter IX., on Mechanical Tests of Wire, should be read by every one who wishes to push himself forward in the telephone business. Although the book contains 189 pages and 108 illustrations, and is handsomely and very substantially bound in full cloth, the price, postage prepaid, is only $1.50.

THE ELECTRIC LIGHT.

THE EDISON LIGHT IN KNOXVILLE, TENN.—Mr. A. S. Kissell has introduced the Edison light at Knoxville, Tenn. He began his work by a contract with the Southern Car Works Co., and on the 8th inst. a successful exhibit was made of the light in their building and offices, in the presence of the officers of the car company, the Mayor and Board of Aldermen of the city, the railroad officers and a number of citizens. The beautiful light gave great satisfaction.

AT LOWELL, MASS.—The Middlesex Electric Light Co. at Lowell, Mass., has an actual service of 250 lights, and has orders for more on its books. Another 25-light dynamo will be put in operation at once. The first quarterly dividend of two per cent. is payable January 1st. The directors are Alderman Fifield, Charles R. Kimball, J. A. Knowles, Jr., W. P. Burbank, Geo. L. Huntoon, Edward P. Dennis, W. A. Ingham, L. N. Downs, of Lowell, and A. R. Richardson, of East Billerica.

PATENT OFFICE PROCEEDINGS.—In the case of Jablochkoff vs. Brush, with regard to the secondary battery as applied to the electric light, heard before the examiner of interferences, the interference has been dissolved. Brush established by evidence that the device had been in public use for over two years. In the case of Crompton et al. vs. Brush, also respecting secondary battery, in which the plantiffs relied on a foreign patent, a decision has been given in favor of Brush. An application has been refused to extend the time for taking testimony in the cases of Keith, Shaw, and Brush vs. Faure, and Keith, Shaw, Maloney and Brush vs. Faure.

A FIRE CAUSED BY ELECTRIC LIGHT WIRES.—Fire Marshal Sheldon has made an investigation of the origin of the fire caused by electric light wires at No. 121 Fulton street, occupied by Wynkoop & Hallenbeck, on the evening of the 8th inst. He reported as follows: An electric light wire of the United States Illuminating Company was resting upon an iron wire attached to a window-sill in the second story of the building and upon the end of a projecting pole used for advertising purposes. The insulation of the wire was chafed off. The current passed the guy wire to the window-sill, where it came in contact with a telephone wire and passed to the telephone box in the building, burning it out, and thence to the telephone station at No. 198 Broadway, doing some damage there.

THE CONSOLIDATED CO. OF MAINE.—The annual meeting of this company was held on the 12th inst. at Portland, Me. The Consolidated company was organized last summer, and adopted the American system of electric lighting. Operations were commenced on September 1, and the 100 light station at Old Orchard Beach, which was built by the American company last summer, was acquired. A 150 light plant has been completed in Portland, and is now in successful operation and earning a profit far in excess of the expectations of the directors when the company was organized. The plant will soon be increased to full 200 light capacity, as the business is rapidly increasing. The contract made with the American Electric and Illuminating company of Boston for the construction of a 200 light station in Lewiston is nearly completed, and it is expected that 100 lights will be turned on in Lewiston and Auburn this week. The following directors were elected for the ensuing year: Hon. Franklin J. Rollins, collector of internal revenue; Payson Tucker, general manager of the Eastern & Maine Central Railroad; Charles R. Milliken, William A. Wood, George A. Thomas, D. W. Coolidge, Elias Thomas, all of Portland; Hon. Jos. R. Bodwell, of the Bodwell Granite Company, Hallowell; Hon. George C. Wing, Auburn; Henry Staples, Old Orchard; William A. Cromwell, of the Lake Shore & Michigan Southern railroad; Silas Gurney and Edward H. Goff, of Boston.

MISCELLANEOUS NOTES.

STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted as follows on Thursday, at the Electric, Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

	BID.	ASKED.
TELEPHONE.		
American Bell Telephone	....	175
Bay State Telephone	98	99
Boston & Northern	100	105
Central American	115	. .
Continental	....	15
Dolbear	5	10
Erie	37	50
Hudson River	90	100
New York and New Jersey	85	...
New York and Pennsylvania	....	72
National Bell (new)	65	70
Overland	1	7
People's	5½	7¾
Shaw	10	17
Southern New England	180	190
Suburban	100	110
Southern Bell	95	125
Tropical	1¾	1⅞
TELEGRAPH.		
Commercial Telegram, pref	....	125
Postal Telegraph (stock)	4.90	5.13
Postal Telegraph Bonds with stock	....	45
ex. "	35	45
Postal Telegraph (new Co.)	1⅛	5
Western Union Telegraph	76½	76⅝
Bankers and Merchants' Tel.	....	119¾
Am. Tel. & C. Co.	62	63
American District Telegraph	....	28
Mutual Union Telegraph	17	18
ELECTRIC LIGHT.		
American	1	5
Brush	50	75
Brush Illuminating	50	70
Daft	....	90
Edison	140	145
Edison Illuminating	38	55
Edison Isolated	100	....
Edison, European	10	28
Excelsior	....	35
Fuller Electrical	10	28
Swan	....	92½
United States	100	115

WET HAY THE CAUSE.—The break in the train wire near Mariana, on the Gould system, says the St. Louis *Globe-Democrat*, has been located after much trouble. Repeated testings failed to indicate the spot till it was discovered that a wet straw from a wet bale of hay in the freight depot in some way connected two of the wires that were carried under the floor. The next agent who reports a break will probably be asked "if he has any wet hay in his warehouse."

CHEAPNESS AND EXCELLENCE HAND IN HAND.—The invariable remark made by those looking over Lieut. Swift's new book, "The Practical Telegrapher," is: "How reasonable the price is for such a book!" This is so. The book contains 189 pages and 108 illustrations, and is printed on heavy, fine, tinted paper and unusually well bound, yet the price is only $1.50. "Pope's Modern Practice," which up to this time—outside of Prescott's—has been the only standard American work on the subject, has been sold at $2 a copy, although it has neither so many pages nor so many cuts. The price of Pope has now, however, been reduced to $1.50, and it is a good book, though, of course—being written in 1871—it is not up with the times in many of the important applications of electricity. In our book publications, as in the papers, we have endeavored to furnish the best information at the most reasonable price, and this may account for their popularity.

CAR PROPULSION BY FAURE ACCUMULATORS.—It is stated that when the Continental Hotel, Paris, was recently lighted up by electricity for the first time, under the Faure system, the stored electrical energy was carried to one of the doors of the hotel in a cart. In a few moments communication was established with the candelabra in the largest room on the first floor, in the presence of some 300 guests. Many of the persons who witnessed this performance afterward made a trip to the Arc de Triomphe and back in a tramcar that was propelled by electricity supplied from the same accumulators. In this way a test was made of the availability of the power stored.

THE DAFT MOTOR.—The electric motor which was placed on the Saratoga, Mount McGregor and Lake George Railroad by the Daft Company has been repaired and is now said to be running satisfactorily on the road. The road has been closed for the season as regards passengers, but negotiations are now in progress for equipping it with three electric motors, which will be ready for the opening of business next May. In connection with the experiments made with the motor on the road on the 15th inst. wires were connected with the track and a current of electricity run off to a saw-mill near by. While the motor was dragging an 18-ton car up the heavy grade of the mountain, 3-inch boards were being sawed out by electricity in the mill.

BUSINESS NOTICES.

A. V. MESEROLE'S ELECTRICAL APPARATUS.—Mr. A. V. Meserole, 22 New Church street, New York, has issued a tasteful catalogue and price list of electrical apparatus that he sells. The pamphlet is liberally illustrated and the descriptions are so minute and accurate as to enable any intending purchaser to know at once whether a certain article enumerated will suit him. Our opinion is that he must be hard to please who cannot satisfy his wants from Mr. Meserole's stock.

THE U. S. MUTUAL ACCIDENT ASSOCIATION.—This association has literally leaped into popularity, and its membership is increasing daily at an unparalleled rate. On January 1 the membership fee is to be increased to all whose applications have not been received before that date, so that those intending to avail themselves of the substantial benefits offered should not delay. The President of the company is Charles B. Peet, of Rogers, Peet & Co., and Mr. James R. Pitcher is secretary. Application blank will be forwarded to any address, and on its return, filled up and accompanied by $4, a policy will be promptly mailed.

EDSON'S STEAM RECORDING GAUGES.—We have more than once called attention to the high merits of the Edson Steam Recording and Alarm Gauges. A very interesting exhibit is now made by Mr. M. B. Edson of the gauge, in front of his establishment, 77 Liberty street, New York. One gauge records the pressure of water in the city's distributing pipes in the street, and the other shows the pressure of steam in the pipes of the N. Y. Steam Co. for heat and power purposes. The gauge has been tried in hundreds of works, factories, offices, etc., and is invariably found to give satisfaction in filling the claims made for it by the inventor. Where it is used the danger of explosion and fire is minimized and prevented.

LITHOGRAPHING, TYPE-WRITING AND AUTOGRAPHIC MANUSCRIPT is a specialty which Messrs. Katte & Humphrey, 49 Cedar street, are enabled to furnish to all classes of businesses and trades, at rates within the reach of all. They will furnish prices with samples on application or by mail. We recommend to electricians desirous of studying short-hand and type-writing an interesting little pamphlet on the subject, by F. S. Humphrey, of the firm of Katte & Humphrey, 49 Cedar street, stenographers, tpye-writers and lithographers. It is full of valuable hints and information, and will remove misconception from the minds of many. The firm give lessons in phonography, orally or by mail, and also give instruction in the use of the type-writer. They offer special terms in connection with the purchase of the machines from them. The advice given as to the best means of pursuing a course of study is very sound. It is that of a practical, experienced man.

THE "ELECTRICAL WORLD'S" ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

ALL THE PATENTS MENTIONED BELOW ARE DATED DEC. 4, 1883.

Circuit-Closer for Burglar Alarms; James Lazelle, of Jersey City, N. J. 289,665

This is a rotating circuit closer consisting of a disc of insulating material having on its periphery a short curved strip of metal that touches two contact springs when the disc is turned. Two pins projecting from the disc limit its movement.

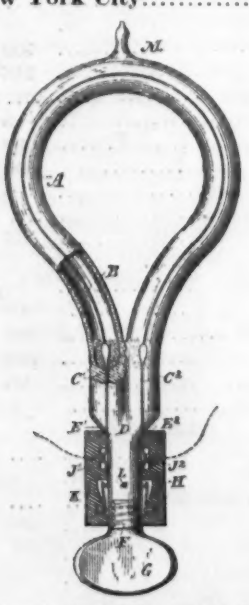
Circuit-Breaker and Lightning-Arrester for Electric Circuits; J. W. Dyer, of Philadelphia, Pa., Assignor to the Automatic Current Protector and Electric Manufacturing Company 289,630

This instrument is interposed in a line and acts as a lightning arrester and as a circuit breaker, to be operated by heavy currents such as proceed from dynamos.

Electric Lighting Apparatus; N. S. White, of Canton, Mass. 289,590

A wire gauze envelope surrounds an incandescent lamp to prevent ignition of inflammable or explosive vapors should the lamp be broken. The improvement is intended for use in places where the atmosphere is filled with inflammable dust or vapor.

Incandescent Electric Lamp; Robert J. Sheehy, of New York City 289,436



The illuminating conductor or filament in this lamp is inclosed in a curved tube of glass, the filament traversing the axis of the tube. The advantages claimed for this construction are: Decreased liability to breakage, owing to the equalized effect of the heat; greater efficiency and approximately equal illumination in all directions.

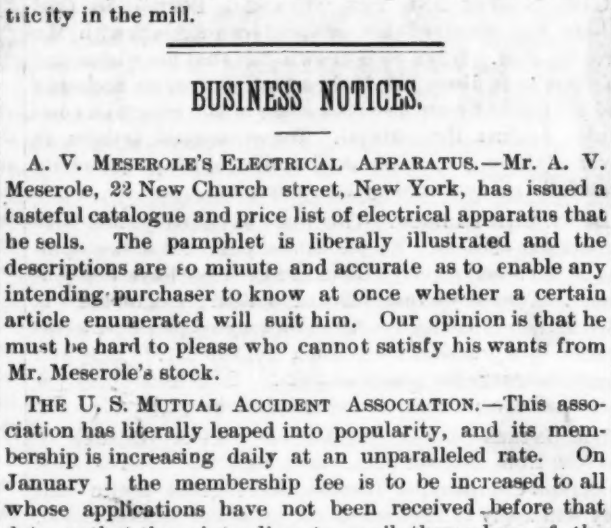
Electric Conductor; Sumner Tainter, of Washington, D. C. 289,725

This is a compound conductor comprising an insulated central conductor enveloped in one or more folded metal strips, and having the spaces between the folded strips and central insulated conductor filled with paraffine or similar material.

Electric Annunciator; A. C. Palmer, of Utica, N. Y. 289,552

The improvement relates to annunciators for hotels, burglar alarms, &c., and it consists in a novel arrangement of the indicator.

Thermo Electric Battery; A. K. Eaton, of Brooklyn, N. Y. 289,631



This invention is based upon the fact that a current may be generated from electrodes of the same material, under different molecular conditions. The elements in this thermal pile consist of chilled and unchilled iron. *A A* are the soft iron electro-positive elements, and *B B* are the chilled iron electro-negative elements. A complete battery consists of a number of such groups of elements as are shown in the engraving.

Electro Motor; C. A. Jackson, of Lawrence, Mass., Assignor of one-half to D. F. Robinson, of same place 289,540. 289,541

The motor operates by step by step mechanism. An armature lever carries pallets working in an escape wheel. On the scape wheel shaft there is a commutator disc, arranged with suitable contact springs to make and break the circuit at the proper intervals to produce the necessary vibrations of the armature lever.

Electric Burglar-Alarm; James Tomney, of New York City 289,470. 289,471

A galvanometer placed in the alarm circuit is located in the office and connected with a second circuit. Any change in the resistance in the main circuit deflects the galvanometer and causes an alarm.

Electric Annunciator; Frederick Happersberger, of Madison, Ind. 289,411

This patent covers a novel and ingenious arrangement of annunciator drops and device for replacing them after they have been exposed to view.

Insulator; N. Rousseau, Chicago, Ill., Assignor of one-half to James W. Brennan, of same place 289,449

The object of this invention is to provide an insulator which will better guard against the escape of the current than others in use, and which will better sustain the ends of a divided wire. It has two storm shields and two grooves for wire, one groove being located between the two shields.

Lightning-Arrester; J. W. Dyer, of Philadelphia, Assignor to the Automatic Current Protector and Electric Manufacturing Co. 280,629

Automatic mechanism grounds the circuits upon their becoming overcharged, and automatically reinsulates the line after the excessive charge is grounded.

Process of Making Electrodes; Willard E. Case, of Auburn, N. Y. 289,386

An element for secondary batteries is made by melting lead and stirring it until it becomes cooled to a plastic condition, and then, while in a plastic condition, pressing the lead into a mold of suitable shape.

Telephone System; C. A. Jackson, of Lawrence, Mass., Assignor to D. F. Robinson, of same place 289,529

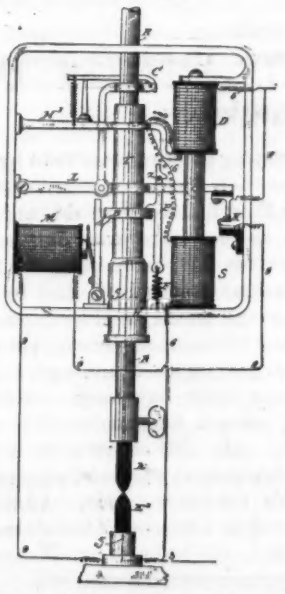
This patent covers an improved method and apparatus for making connections at the telephone central office.

Telegraph Wire; Thomas Shaw, of Newark, N. J. 289,575

This wire is composed of a core wire and a series of tubular sections secured together at their extremities and drawn into one continuous wire.

Safety Device for Electric Arc Lamps; Elihu Thomson, of New Britain, Assignor to the Thomson-Houston Electric Company, of Connecticut 289,580

The engraving shows the application of the invention to a



clutch or clamp lamp. The frame *T* and the guides for the carbon are free to move vertically, either by their own weight, or by the action of a spring, but are normally restrained from moving by a catch or detent *A*, which engages with a projection *B* on the frame *T*, but may withdraw from engagement with the projection by the action of the safety magnet *M*, when the frame or guides are released a spring *F* pulls them down forcibly through the intervention of the piece *P*. The spring *F* also acts through the piece *P* and projection *a* to pull the lever *L* down forcibly and to hold it down, thus producing a complete disengagement of the carbon-feeding devices. The spring *F* prevents the re-engagement of the lifting or feeding devices. The magnet *M* is energized by the closing of contacts *K*, connected with the feed-regulating lever *L*, and arranged to close circuit 2, containing the said magnet and derived from the main circuit, whenever an abnormal or dangerous increase in the length of the arc occurs, and allows the lever to recede to an abnormal extent.

All Persons Sending for

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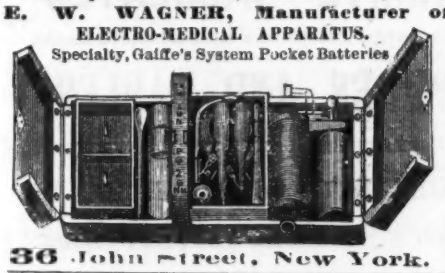

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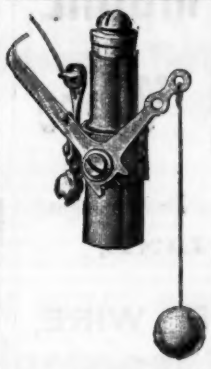

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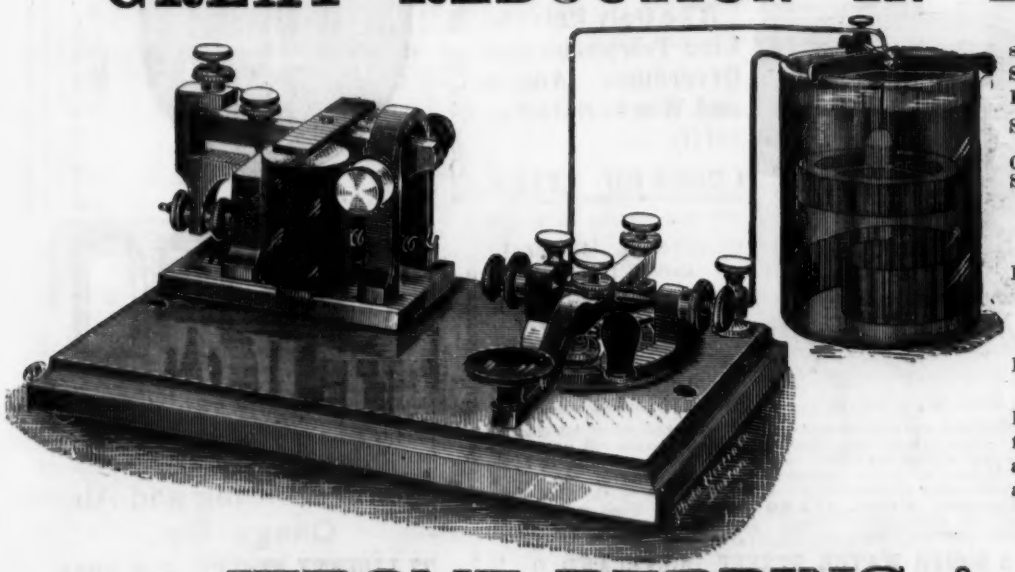

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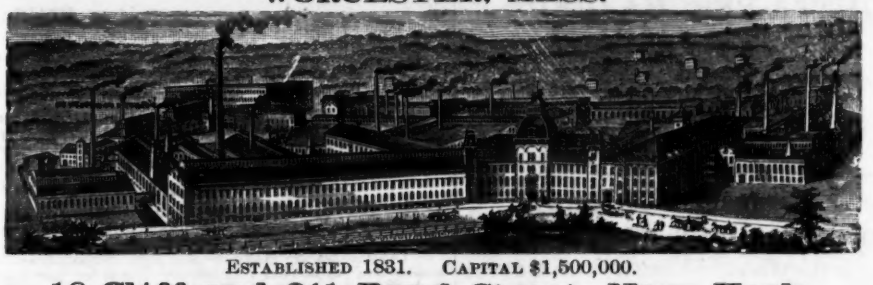

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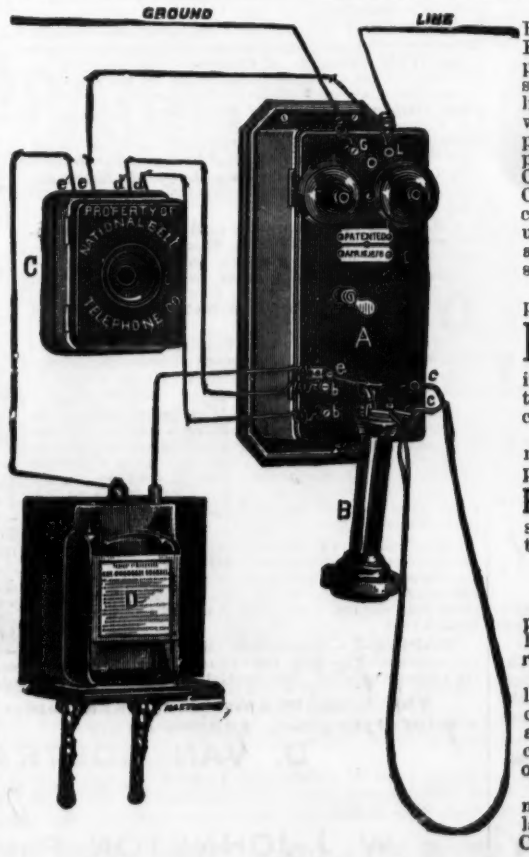

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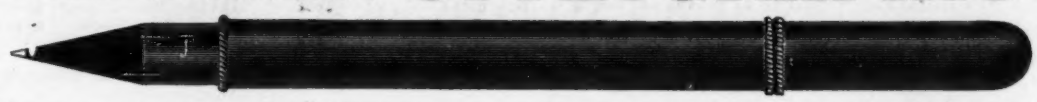
$1.00.  $1.00.

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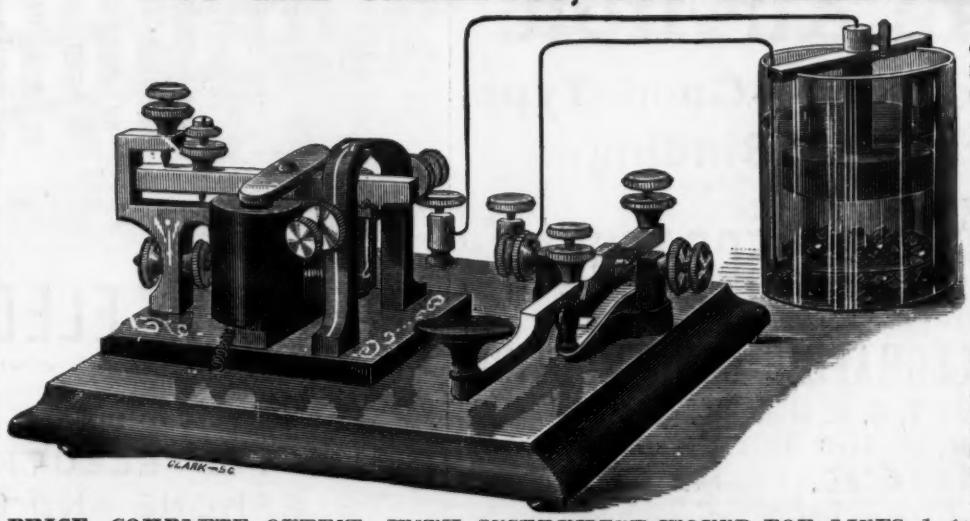

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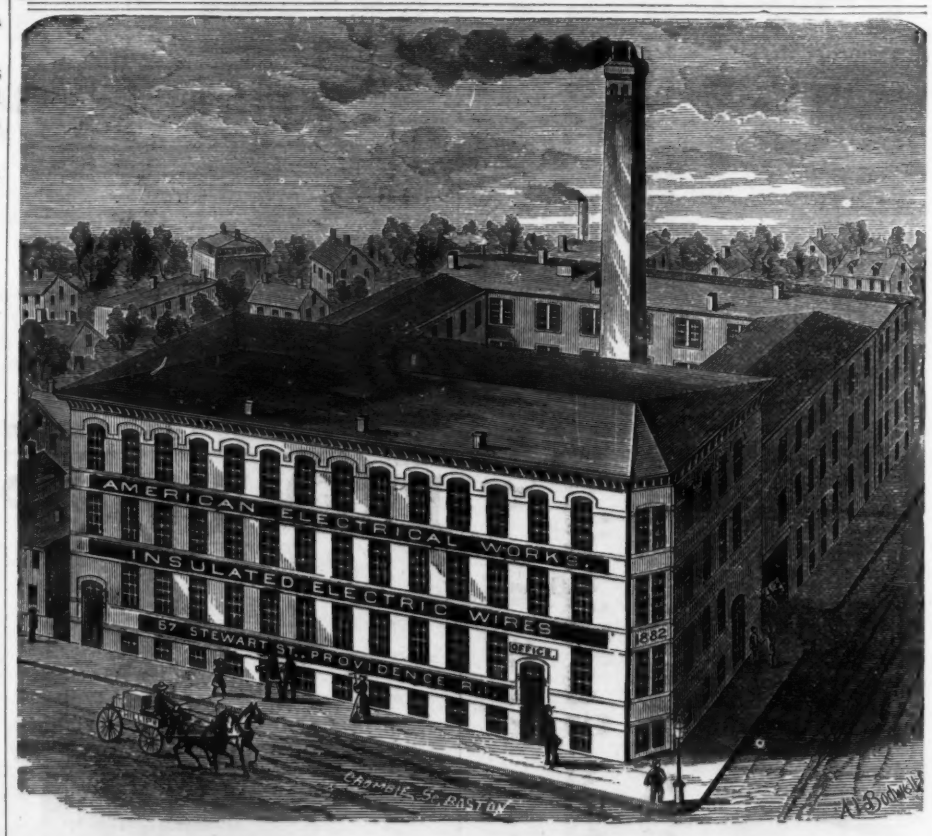

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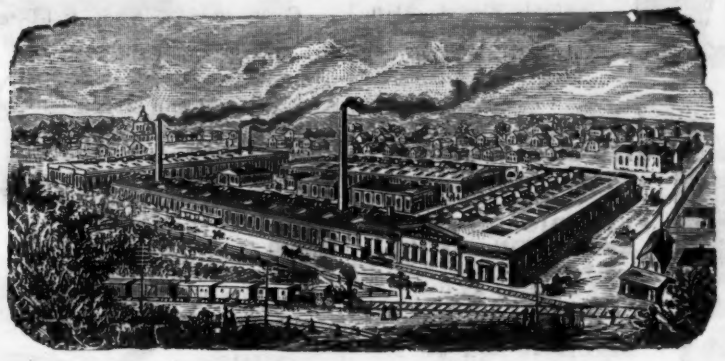

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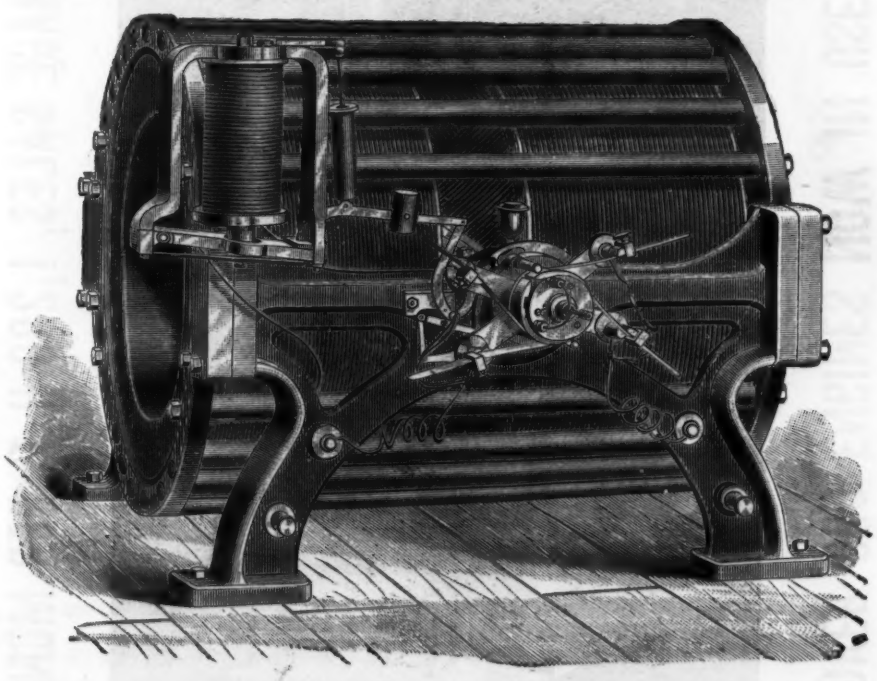

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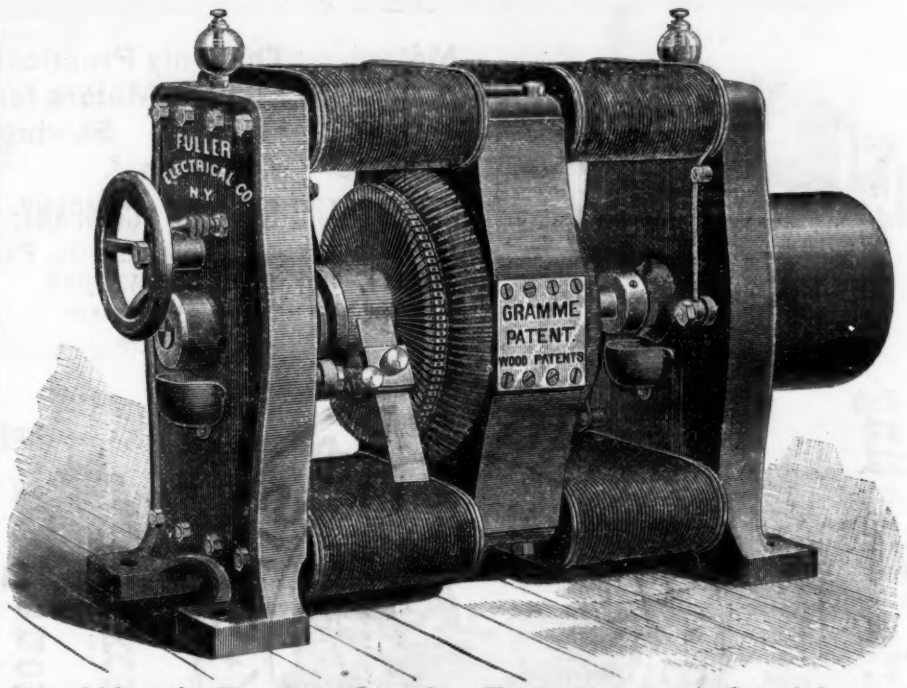

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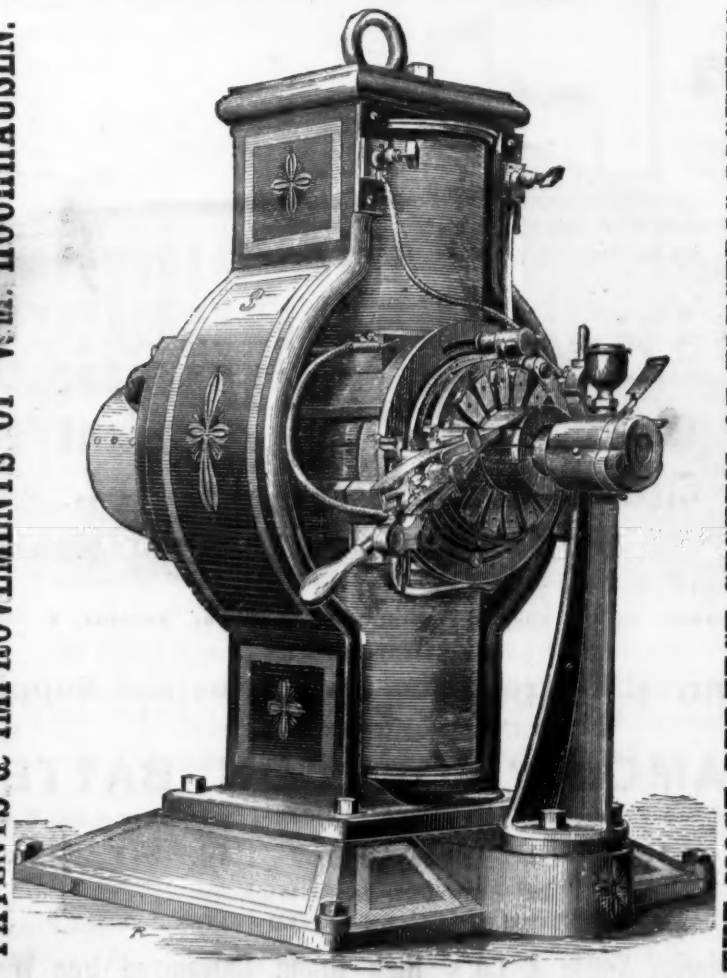

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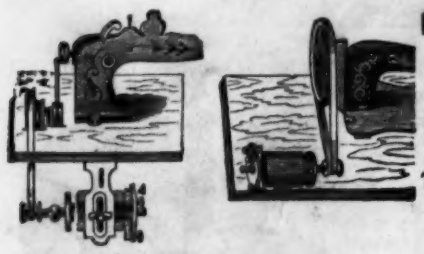

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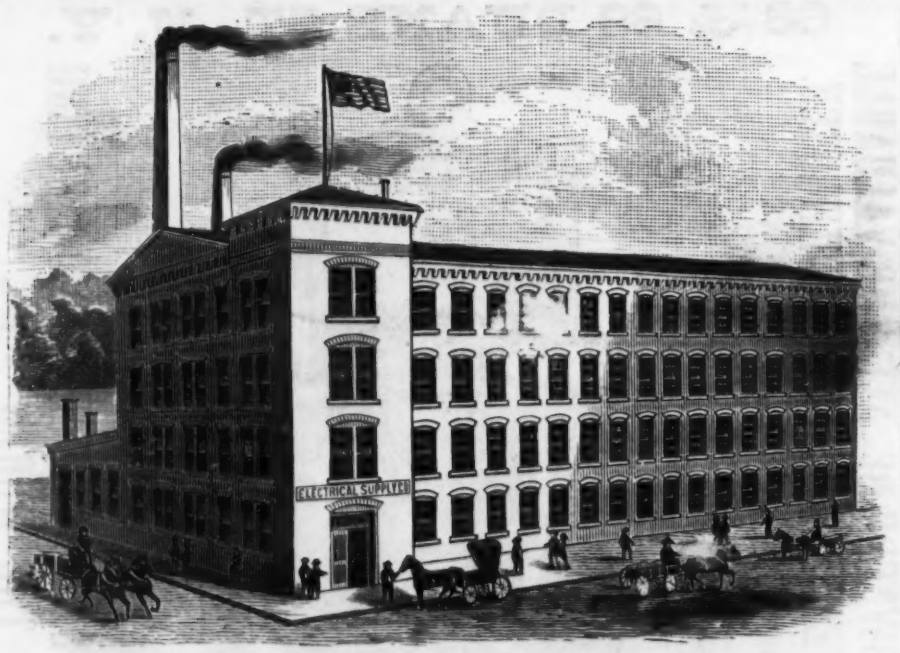

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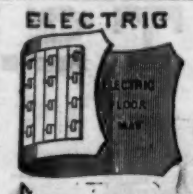

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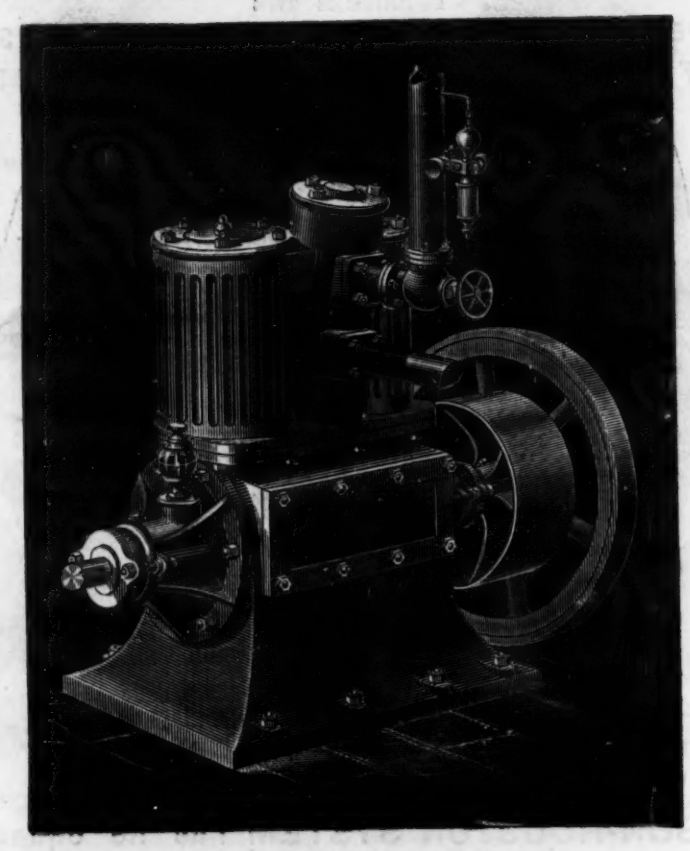

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